

Model Name: **P520HW01 V0**

Product Specification

Product Description: 52" Full HD Color TFT-LCD Module**AUO Model Name: P520HW01 V0****Customer Part No. / Project Name:****Customer Signature****AU Optronics Corp.**

Approved by: PM Head

Jackie Hsu

Reviewed by: RD Head

Kelvin Chou

Reviewed by: Project Leader

Gary Hung

Prepared by: PM

KT Huang**Note**

Model Name: **P520HW01 V0**

Product Specification

Rev.0.3**Date: 2009/08/21**

Product Functional Specification

52" Full HD Color TFT-LCD Module

Model Name: **P520HW01 V0****() Preliminary Specification****(*) Final Specification**

Note: This specification is subject to change without notice.

Model Name: **P520HW01 V0**

Product Specification

Contents

No	
	CONTENTS
	RECORD OF REVISIONS
1	GENERAL DESCRIPTION
2	ABSOLUTE MAXIMUM RATINGS
3	ELECTRICAL SPECIFICATION
3.1	SIGNAL ELECTRICAL CHARACTERISTICS
3.2	SIGNAL INTERFACE CONNECTOR
3.3	SIGNAL TIMING SPECIFICATION
3.4	SIGNAL TIMING WAVEFORM
3.5	COLOR INPUT DATA REFERENCE
3.6	BACK LIGHT POWER SPECIFICATION
3.7	POWER SEQUENCE
4	OPTICAL SPECIFICATION
5	MECHANICAL CHARACTERISTICS
6	PACKING
7	RELIABILITY TEST
8	INTERNATIONAL STANDARD
9	PRECAUTIONS

Model Name: **P520HW01 V0**

Product Specification

Record of Revision

Rev.	Data	Page	Items	New Description				Remark
0.0	Sep 22,'08		First Draft					
0.1	Jan 06,'08		Correct RA criteria					
0.2		6		Color Gamut	72	%	NTSC	
		6		Total Power Consumption	300 (typ.)	W	include BLU & Signal	
		6		Life Time (minimum)	50,000	hours	1	
		6	Note 1: Duration = 50msec	Note 1: If operate over spec but under a absolute maximum rating, duration must be < 50ms				
		6	Note 2: Maximum Wet-Bulb should be 39°C and No condensation.	Note [2]: Maximum Wet-Bulb should be 39°C and no condensation. The relative humidity must not exceed 80% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced				
		9		External PWM Frequency : 180 Hz (Typ)				
		11	Pin 32: LVDS Even pixel data input pair(-)	Pin32: LVDS Even pixel clock input pair(-)				
		11	Pin 33: LVDS Even pixel data input pair(+)	Pin33: LVDS Even pixel clock input pair(+)				
		12	Pin 40: NC/ No connected	Reserved/ Open or High				
		12	Pin 41: NC/ No connected	Reserved/ Open or High				
		12	Pin 51: NA/ No connected	Reserved/ Open or Low				
		14	Connector 1: S14 B-PH-SM4-TB	Connector 2: S14B-PH-SM4-TB				
		15	Connector 2,3,4:	Connector 3,4,5: S12B-PH-SM4-TB				

Model Name: **P520HW01 V0**

Product Specification

			S12B-PH-SM4-TB		
		23	$I_{\text{DDB}} = 7.5 \text{ A}$	$I_{\text{DDB}} = 12.5 \text{ A}$	

Model Name: **P520HW01 V0**

Product Specification

1. General Description

This specification applies to the 52 inch Color TFT-LCD Module P520HW01 V0. This LCD module has a TFT active matrix type liquid crystal panel 1920x1080 pixels, and diagonal size of 52.0 inch. This module supports Full HD mode (non-interlace).

Each pixel is divided into Red, Green, and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined by 10-bit gray scale signal for each dot.

The P520HW01 V0 has been designed to apply the 10-bit 2-channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, and high color depth are important.

The P520HW01 V0 is RoHS verified which can be distinguished on panel label.

◆ General Information

Items	Specification	Unit	Note
Active Screen Size	52.0	inches	Diagonal
Display Area	1152 (H) x 648 (V)	mm	
Outline Dimension	1192(V) x 688(H) x 61(D)	mm	With inverter
Driver Element	a-Si TFT active matrix		
Display Colors	1073.7M (10-bit)	colors	
Color Gamut	72	%	NTSC
Number of Pixels	1920 x 1080	pixel	
Pixel Arrangement	RGB vertical stripe		
Pixel Pitch	0.6	mm	
Display Mode	Transmissive, Normally Black		
Surface Treatment	Super Clear, 3H		
Total Power Consumption	300 (typ.)	W	include BLU & Signal
Life Time (minimum)	50,000	hours	1
RoHS	RoHS compliance		
Display Orientation	Portrait/Landscape enable		

Note 1: The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of horizontally continuous operating at 25±2℃.

Model Name: **P520HW01 V0**

Product Specification

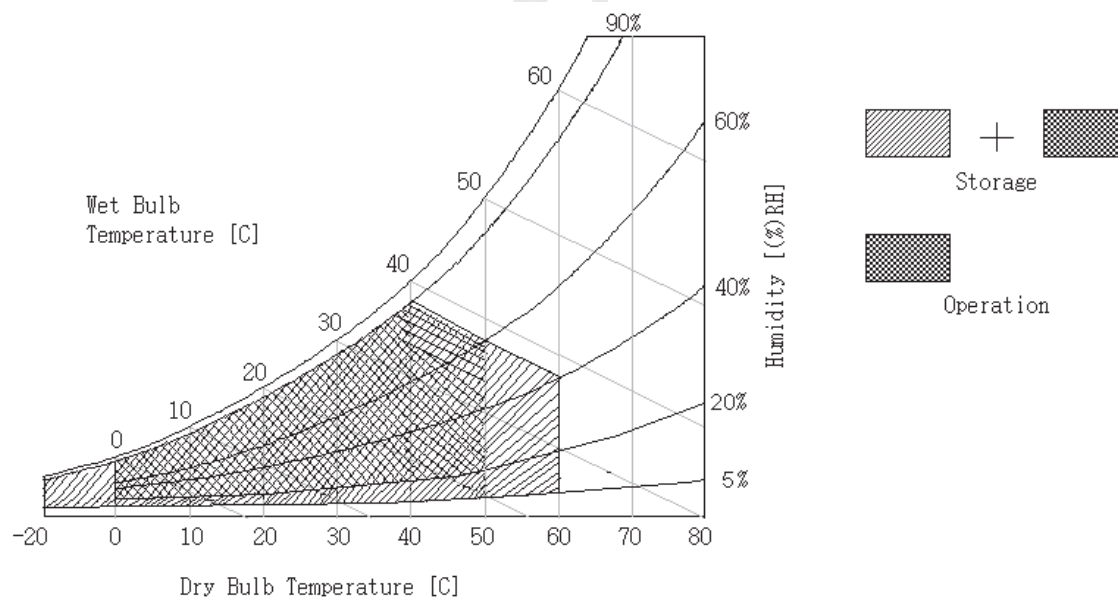
2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit:

Item	Symbol	Min.	Max	Unit	Note
Logic/LCD Drive Voltage	V_{CC}	-0.3	+14.0	V	1
Input Voltage of Signal	V_{IN}	-0.3	+3.6	V	1
BLU Input Voltage	V_{DDB}	-0.3	+26.0	V	1
BLU Brightness Control Voltage	V_{BLON}	-0.3	+5.5	V	1
Operating Temperature	T_{OP}	0	+50	°C	2
Operating Humidity	H_{OP}	10	90	%RH	2
Storage Temperature	T_{ST}	-20	+60	°C	2
Storage Humidity	H_{ST}	10	90	%RH	2

Note 1: If operate over spec but under absolute maximum rating, duration must be < 50ms.

Note 2: Maximum Wet-Bulb should be 39°C and no condensation. The relative humidity must not exceed 80% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.



Model Name: **P520HW01 V0**

Product Specification

3. Electrical Specification

The P520HW01 V0 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter.

3.1 Signal Electrical Characteristics

3.1.1. LCD Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
Power Supply Input Voltage		V_{CC}	11.4	12.0	12.6	V	
Power Supply Input Current		I_{CC}		1.0		A	1
Power Consumption		P_{CC}		12.0		W	1
Inrush Current		I_{RUSH}	--	--	(5)	A	5
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}	--	--	+100.0	mV	4
	Differential Input Low Threshold Voltage	V_{TL}	-100.0	--	--	mV	4
	Common Input Voltage	V_{CIM}	0.6	1.2	1.8	V	
CMOS Interface	Input High Threshold Voltage (High)	V_{IH}	2.0	--	3.3	V	
	Input Low Threshold Voltage (Low)	V_{IL}	0	--	0.8	V	
Backlight Power Consumption				300	330	W	2
Lamp Life Time			50,000	60,000			

3.1.2. Backlight Characteristics

No	Item	Symbol	Test Condition	Min	Typ	Max	Unit	Note
1	Input Voltage	V_{DDB}	--	22.8	24	25.2	V	
2	Input Current	I_{DDB}	$V_{DDB}=24V$ 100%brightness	TBD	12.5	TBD	A	1
3	Input Power	P_{DDB}	$V_{DDB}=24V$ 100%brightness	TBD	300	TBD	W	1
4	Input Inrush current	I_{RUSH}	$V_{DDB}=24V$ 100%brightness	--	--	TBD	A	2

Model Name: **P520HW01 V0**

Product Specification

5	Output Frequency	F_{BL}		$V_{DDB}=24V$		58		KHz	
6	On/Off Control Voltage	V_{BLON}	On	$V_{DDB}=24V$	2.0	3.3	5	V	
			Off	$V_{DDB}=24V$	0.0	--	0.8	V	
7	On/Off Control Current	I_{BLON}		$V_{DDB}=24V$	0	--	2	mA	
8	External PWM Control Voltage	EV_{PWM}	Max	--	2.0	--	3.3	V	
			Min	--	0	--	0.8	V	
9	External PWM Control Current	EI_{PWM}	Max	PWM = 100%	0	--	2	mA	
			Min	PWM = 30%	0	--	2	mA	
10	External PWM Duty Ratio	ED_{PWM}		--	30	--	100	%	
11	External PWM Frequency	EF_{PWM}		--	120	180	300	Hz	
12	Internal PWM Control Voltage	IV_{PWM}		$V_{DDB}=24V$	0	--	3.3	V	

Do not attach a conducting tape to lamp connecting wire. If the lamp wire attach to conducting tape, TFT-LCD Module have a low luminance and the inverter has abnormal action because leakage current occurs between lamp wire and conducting tape.

The relative humidity must not exceed 80% non-condensing at temperature of 40℃ or less. At temperature greater than 40℃, the wet bulb temperature must not exceed 39℃. When operate at low temperature, the brightness of CCFL will drop and the lifetime of CCFL will be reduced.

Note :

1. $V_{dd}=12.0V$, $f_v=60Hz$, $f_{CLK}=75\text{ Mhz}$, 25℃, V_{dd} Duration time= 500 μs , Test pattern : white pattern
2. The Backlight power consumption shown above does include loss of external inverter at 25℃. The used lamp current is the lamp typical current
3. The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25±2℃.
4. $VCIM = 1.25V$

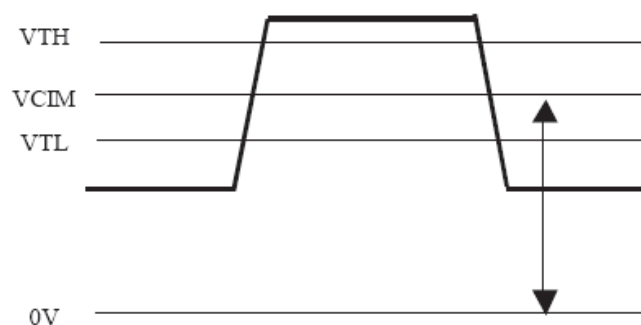
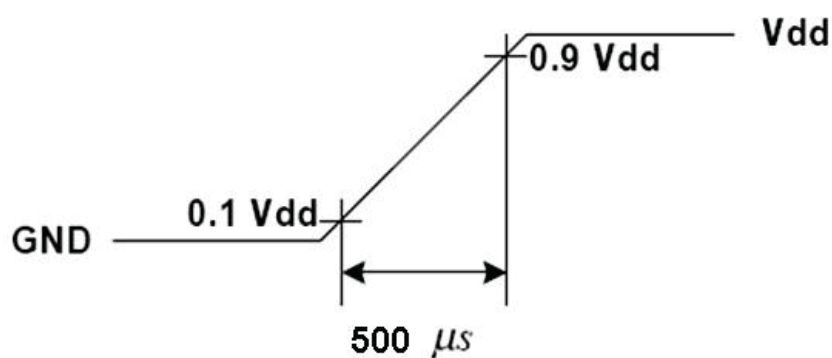


Figure : LVDS Differential Voltage

Model Name: **P520HW01 V0**

Product Specification

5. Measurement Condition: Rising time = 500 μ s

Model Name: **P520HW01 V0**

Product Specification

3.2. Signal Interface Connections

◆ LCD LVDS connector (51pin): JAE FI-RE51S-HF

No.	Symbol	Description	No.	Symbol	Description
1	VCC	+12V Power Supply	27	RXEN1	LVDS Even pixel data input pair 1(-)
2	VCC	+12V Power Supply	28	RXEP1	LVDS Even pixel data input pair 1(+)
3	VCC	+12V Power Supply	29	RXEN2	LVDS Even pixel data input pair 2(-)
4	VCC	+12V Power Supply	30	RXEP2	LVDS Even pixel data input pair 2(+)
5	VCC	+12V Power Supply	31	GND	Ground
6	GND	Ground	32	RXENCLK	LVDS Even pixel clock input pair(-)
7	GND	Ground	33	RXEPCLK	LVDS Even pixel clock input pair(+)
8	GND	Ground	34	GND	Ground
9	GND	Ground	35	RXEN3	LVDS Even pixel data input pair 3(-)
10	RXON0	LVDS Odd pixel data input pair 0(-)	36	RXEP3	LVDS Even pixel data input pair 3(+)
11	RXOP0	LVDS Odd pixel data input pair 0(+)	37	RXEN4	LVDS Even pixel data input pair 4(-)
12	RXON1	LVDS Odd pixel data input pair 1(-)	38	RXEP4	LVDS Even pixel data input pair 4(+)
13	RXOP1	LVDS Odd pixel data input pair 1(+)	39	GND	Ground
14	RXON2	LVDS Odd pixel data input pair 2(-)	40	Reserved	Open or High
15	RXOP2	LVDS Odd pixel data input pair 2(+)	41	Reserved	Open or High
16	GND	Ground	42	NC	No connected
17	RXONCLK	LVDS Odd pixel clock input pair(-)	43	NC	No connected
18	RXOPCLK	LVDS Odd pixel clock input pair(+)	44	NC	No connected
19	GND	Ground	45	LVDSORD	Select LVDS data order: ● High or NC → NS ● Low → JEIDA
20	RXON3	LVDS Odd pixel data input pair 3(-)	46	NC	No connected
21	RXOP3	LVDS Odd pixel data input pair 3(+)	47	NC	No connected
22	RXON4	LVDS Odd pixel data input pair 4(-)	48	NC	No connected
23	RXOP4	LVDS Odd pixel data input pair 4(+)	49	NC	No connected
24	GND	Ground	50	NC	No connected
25	RXEN0	LVDS Even pixel data input pair 0(-)	51	Reserved	Open or Low
26	RXEP0	LVDS Even pixel data input pair 0(+)			

Note: 1. All GND (ground) pin should be connected together to the LCD module's metal frame.

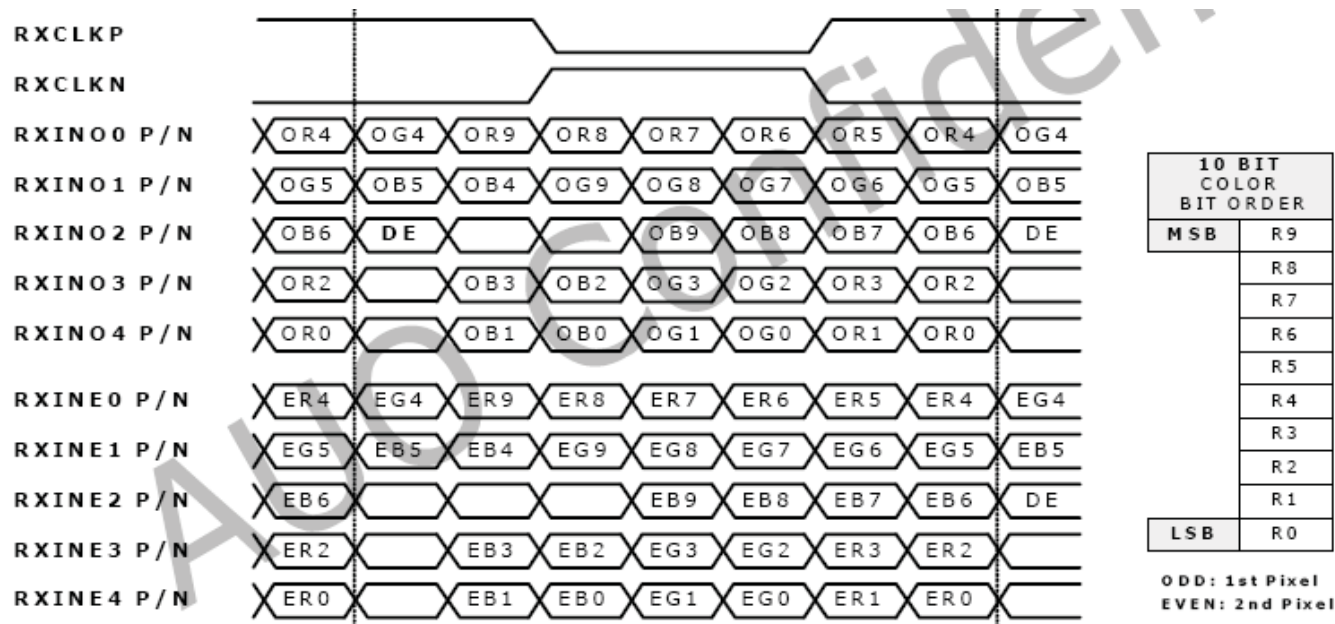
2. All VCC (power input) pins should be connected.

Model Name: **P520HW01 V0**

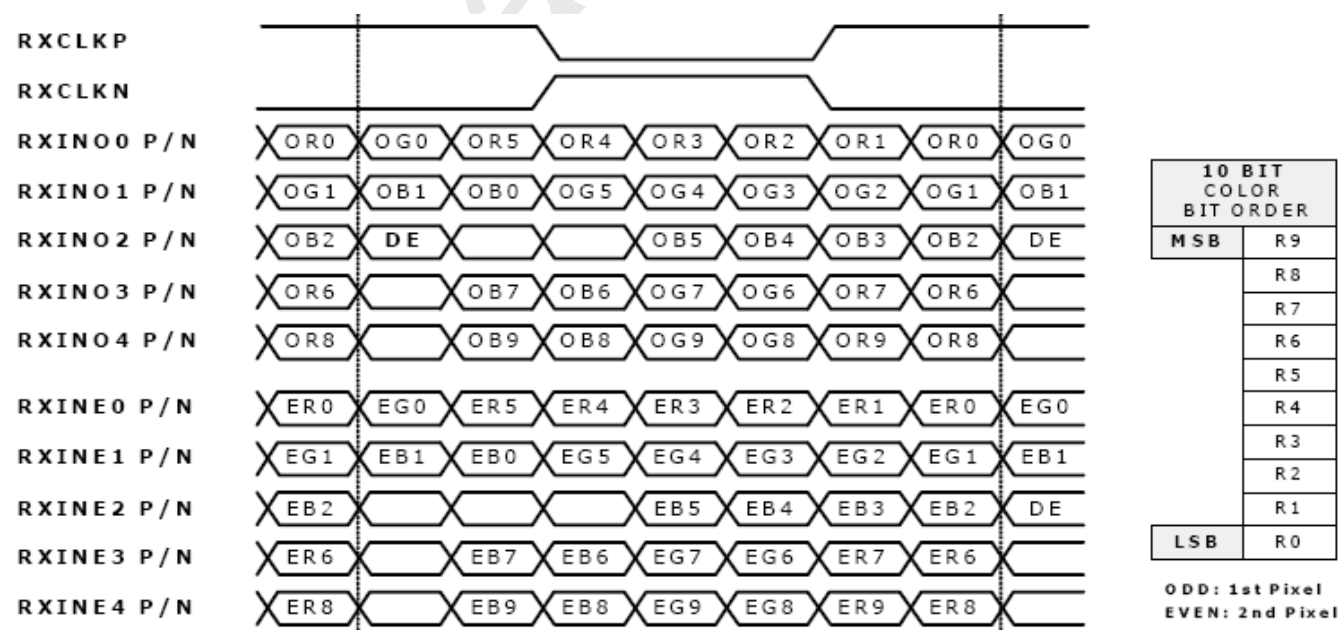
Product Specification

The 10 bits LVDS Input Data Mapping

- JEIDA mode LVDS Input (LVDSORD = Low)



- NS-like mode LVDS Input (LVDSORD = High or NC)

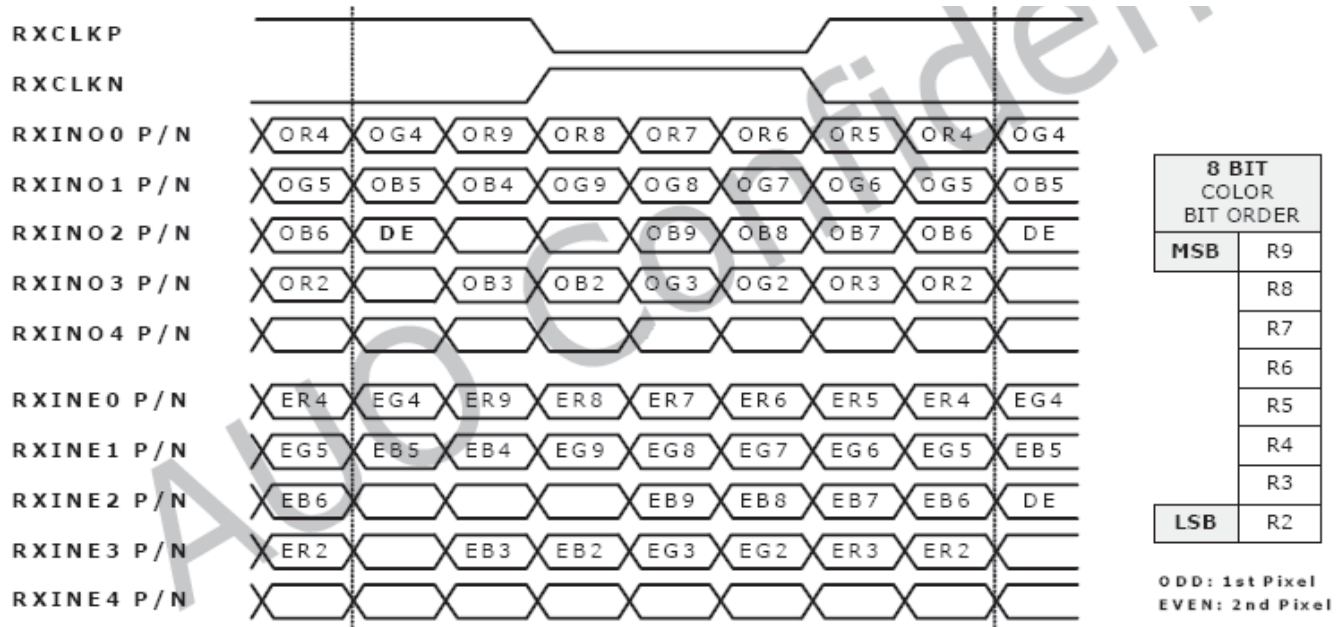


Model Name: **P520HW01 V0**

Product Specification

The 8 bits LVDS Input Data Mapping

- JEIDA mode LVDS Input (LVDSORD = Low)

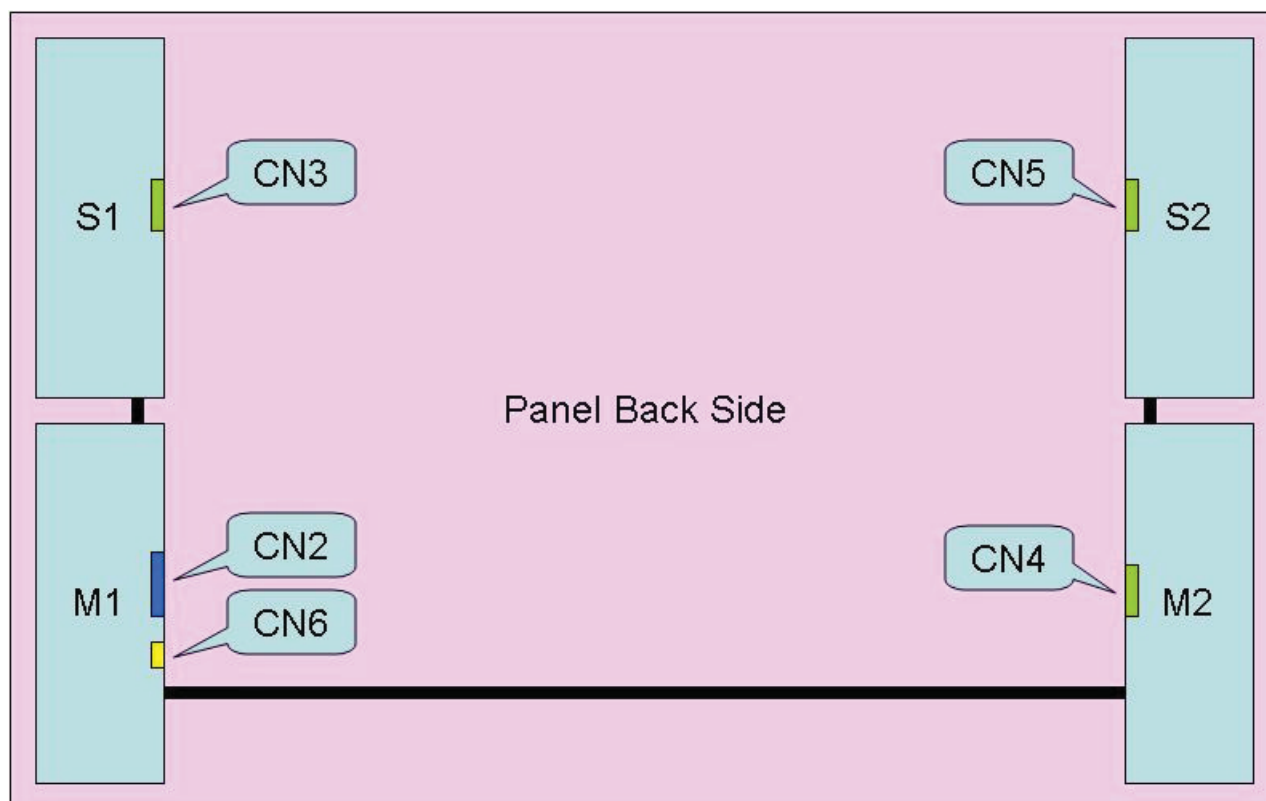


Note : For 8 bit LVDS input application, Panel only can be operated under JEIDA mode and it is important to make sure the LVDS Data pair 4(RXINO4N, RXINO4P, RXINE4N, RXINE4N) does not have any data input. Please follow instruction as below:

- If system has a +1.2V DC regulator voltage, please let negative signal of LVDS Data pair 4(RXINO4N, RXINE4N) connect to +1.2V DC regulator voltage, and let positive signal of LVDS Data pair 4 (RXINO4P, RXINE4P) connect to Ground. (Recommended)
- If system does not have +1.2V DC regulator voltage, please let LVDS Data pair 4(RXINO4N, RXINO4P, RXINE4N, RXINE4N) connect to Ground.

Model Name: **P520HW01 V0**

Product Specification

Backlight Connector Pin Configuration**1. Input specification**

Connector 2: S14B-PH-SM4-TB (JST) or equivalent

Pin No	Symbol	Description
1	VDDB	Operating Voltage Supply, +24V DC regulated
2	VDDB	Operating Voltage Supply, +24V DC regulated
3	VDDB	Operating Voltage Supply, +24V DC regulated
4	VDDB	Operating Voltage Supply, +24V DC regulated
5	VDDB	Operating Voltage Supply, +24V DC regulated
6	BLGND	Ground and Current Return
7	BLGND	Ground and Current Return
8	BLGND	Ground and Current Return
9	BLGND	Ground and Current Return
10	BLGND	Ground and Current Return
11	VDIM	GND: 80%; Open/High (3.3V): 100%, Luminance
12	VBLON	Backlight On/Off: Open/High(+3.3V) for BL on, Low(GND) for BL off
13	PDIM ⁽¹⁾	External PWM Dimming Control input; Open/High (3.3V/100% Duty) for 100% Lum Internal PWM Dimming Control Input: Open/High (3.3V) for 100% Lum; GND for 30% Lum

Model Name: **P520HW01 V0**

Product Specification

14	PDIM Selection ^(2,3)	Dimming mode Selection. GND: External PWM dimming; Open/High: Internal PWM dimming.
----	------------------------------------	---

Note 1: PDIM is PWM duty control input for +3.3V TTL level signal or DC voltage by Pin 14 input. This input signal is (a) continuous pulse signal with +3.3V, 100% duty (i.e. +3.3V, DC level), backlight should perform 100% luminance. Duty ratio of this input signal should be proportional relationship in certain range of control without any kind of inherent side effect like waterfall effect on screen. Guaranteed duty range and dimming ratio should be specified with supplementary measurement result.

Note 2: Pin 14 is the selection pin for dimming control method; if this pin is connected to High or open, PDIM (Pin 13) input should have DC level signal. Therefore the inverter should have SAW Tooth Wave Generator to generate internal PWM signal. If Pin 14 is connected to GND, PDIM (Pin 13) input should have external PWM signal.

Note 3: Pin 14 selection vs Pin 13 control function table:

	Pin 13 (Default: Open/High 100%)
Pin 14 = GND	External PWM (AC signal control duty)
Pin 14 = Open/High	Internal PWM (DC power control duty)

Connector 3,4,5: S12B-PH-SM4-TB (JST) or equivalent

Pin No	Symbol	Description
1	VDDB	Operating Voltage Supply, +24V DC regulated
2	VDDB	Operating Voltage Supply, +24V DC regulated
3	VDDB	Operating Voltage Supply, +24V DC regulated
4	VDDB	Operating Voltage Supply, +24V DC regulated
5	VDDB	Operating Voltage Supply, +24V DC regulated
6	VDDB	Operating Voltage Supply, +24V DC regulated
7	BLGND	Ground and Current Return
8	BLGND	Ground and Current Return
9	BLGND	Ground and Current Return
10	BLGND	Ground and Current Return
11	BLGND	Ground and Current Return
12	BLGND	Ground and Current Return

Model Name: **P520HW01 V0**

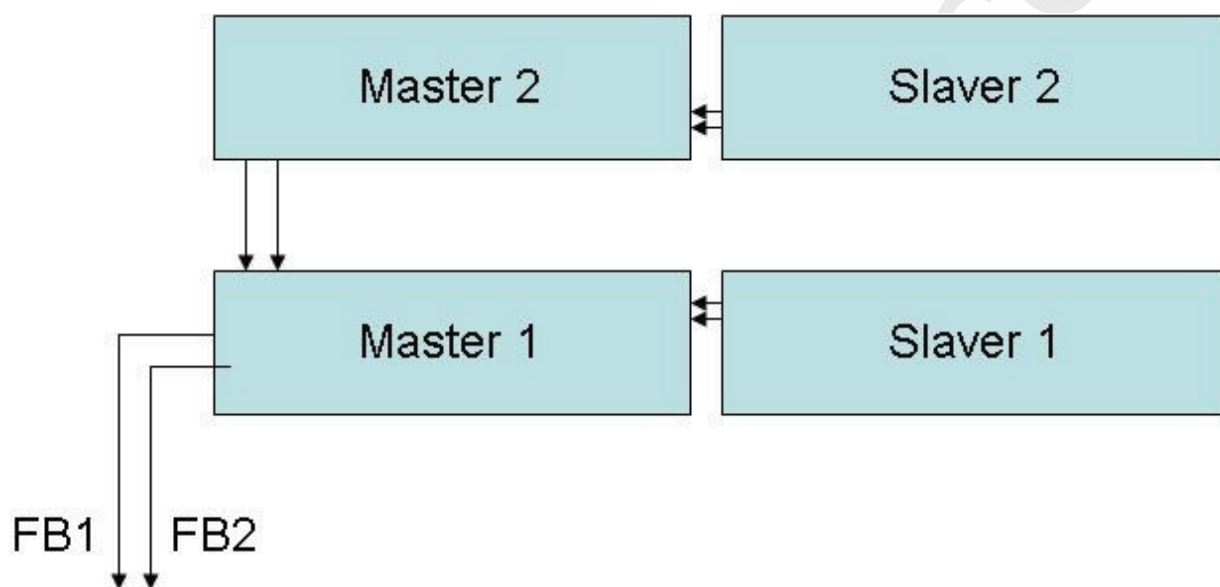
Product Specification

Connector 6 : CI1504M1HR0-LF.(Cvilux)

Pin NO.	Signal name	Description
1	FB1	Feedback pin 1 (Sensor open lamp signal)
2	FB2	Feedback pin 2 (Sensor open lamp signal)
3	Disable	Disable Open Lamp Detection: 1. Open/High : Enable Open Lamp Detection. 2. Low : Disable Open Lamp Detection
4	GND	FB Ground

Note :

Open Lamp Detection Configuration:



Lamp status	(FB1, FB2)	Remark
Normal	(L,L)	No Open Lamp
1 lamp open	(L,H)	Inverter still work and send alarm signal continually.
2~3 lamps open	(H,L)	Inverter still work and send alarm signal continually.
≥ 4 lamps open	(H,H)	Inverter shut down

Model Name: **P520HW01 V0**

Product Specification

3.3. Signal Timing Specification

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

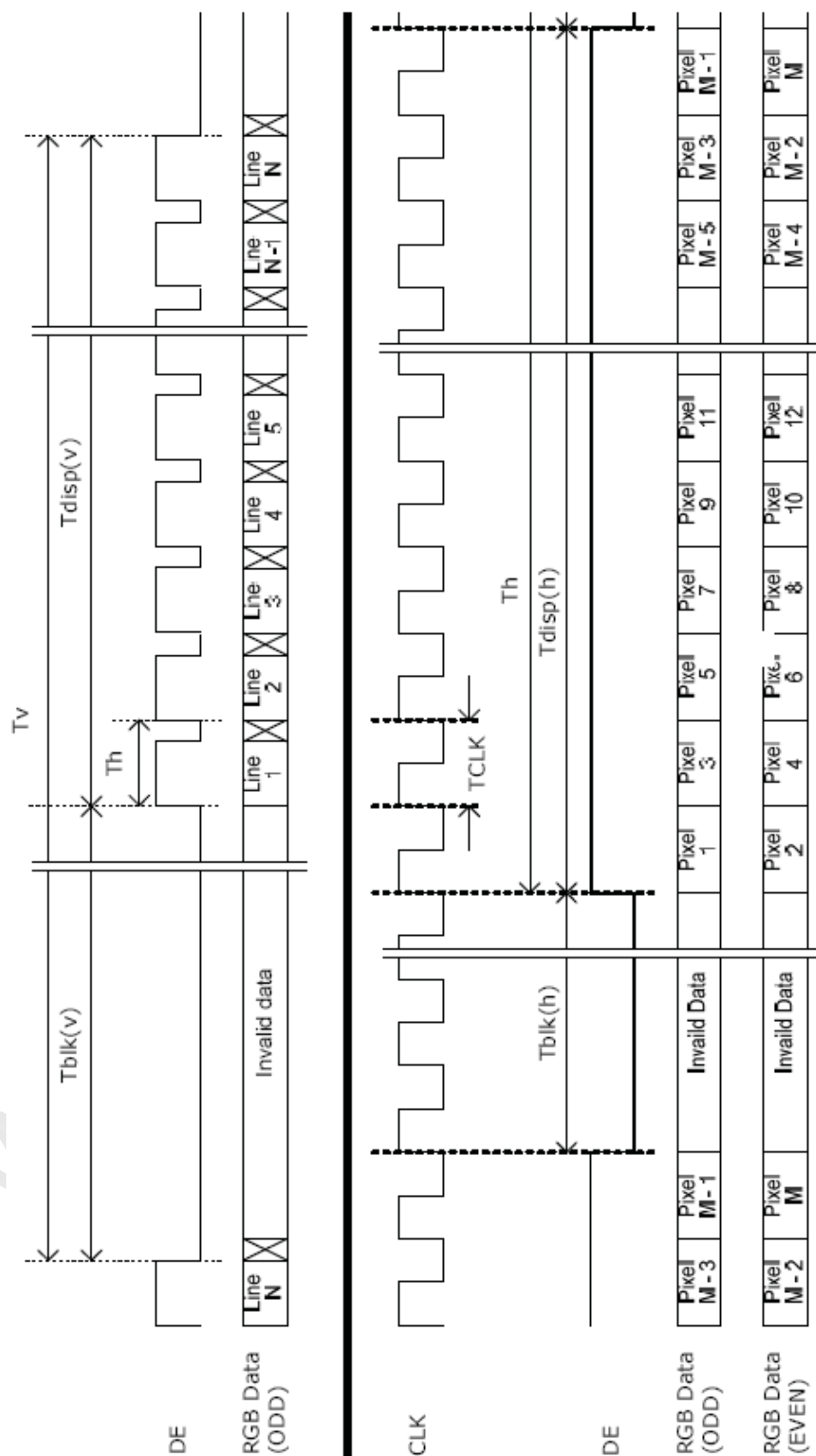
Timing Table (DE only Mode)

Signal	Item	Symbol	Min	Type	Max	Unit
Vertical Section	Period	Tv	1090	1125	1480	Th
	Active	Tdisp (v)	1080			Th
	Blanking	Tblk (v)	10	45	400	Th
Horizontal Section	Period	Th	1030	1100	1300	Tclk
	Active	Tdisp (h)	960			Tclk
	Blanking	Tblk (h)	70	140	340	Tclk
Clock	Period	CLK	20	13.47	12.9	ns
	Frequency	Freq	50	74.25	82	MHz
Vertical Frequency	Frequency	Vs	47	60	63	Hz
Horizontal Frequency	Frequency	Hs	60	67.5	73	kHz

Model Name: **P520HW01 V0**

Product Specification

3.4. Signal Timing Waveform



Model Name: **P520HW01 V0**

Product Specification

3.5. Color Input Data Reference

The brightness of each primary color (red, green, and blue) is based on the 10-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

COLOR DATA REFERENCE

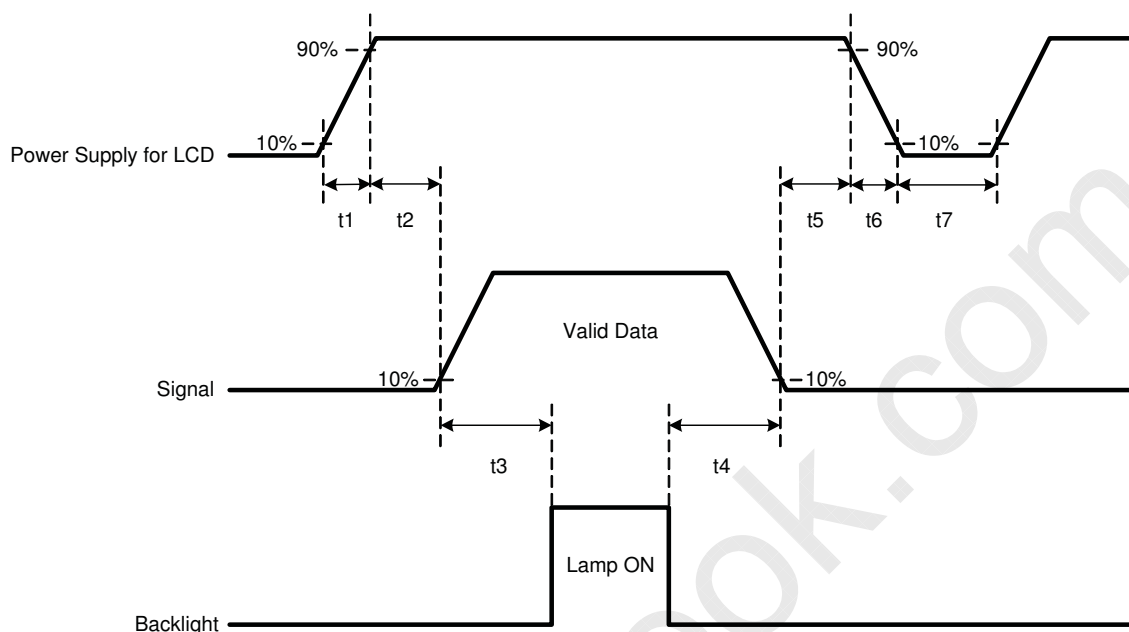
COLOR		INPUT COLOR DATA																															
		RED										GREEN										BLUE											
		MSB					LSB					MSB					LSB					MSB					LSB						
R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0				
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Red(255)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Green(255)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0			
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1			
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1			
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0			
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Red	Red(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	Red(001)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	:																																
	Red(254)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	Red(255)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Green	Green(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	Green (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0				
	:																																
	Green(254)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0				
	Green(255)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0				
Blue	Blue(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	Blue(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1				
	:																																
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0				
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1				

Model Name: **P520HW01 V0**

Product Specification

3.6. Power Sequence

◆ Power Sequence of LCD



Parameter	Values			Unit
	Min.	Typ.	Max.	
t1	0.5	-	20	ms
t2	20	-	50	ms
t3*	800	-	-	ms
t4	200	-	-	ms
t5	50	-	-	ms
t6	0.5	-	30	ms
t7	1.0	-	-	s

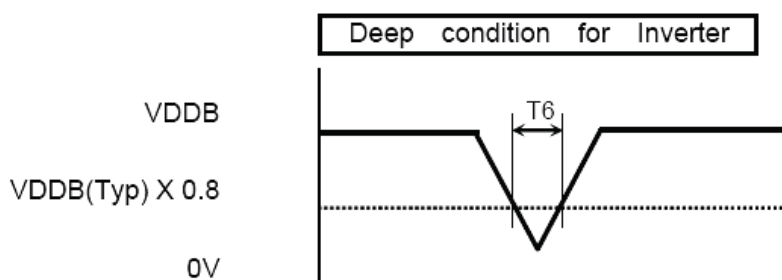
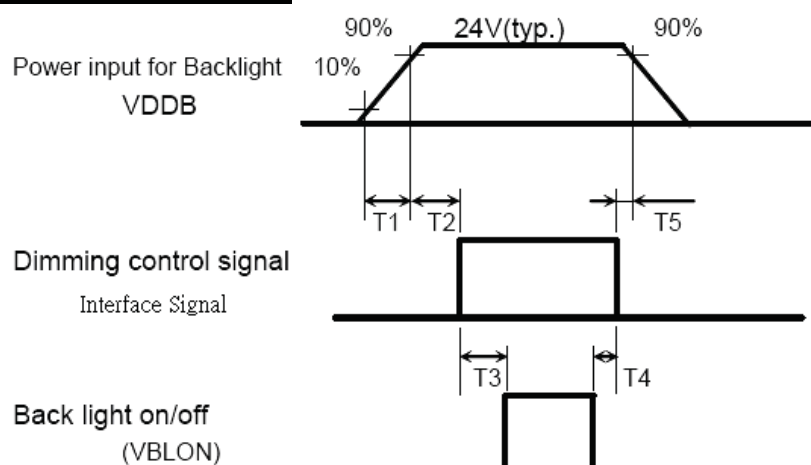
*: If $t_3=200\text{ms}$, input black signal till 700ms from system is necessary. In case of $t_3<200\text{ms}$, the abnormal display will be happened. But it will not damage timing controller.

Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

Caution: The above on/off sequence should be applied to avoid abnormal function in the display. In case of handling, make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

Model Name: **P520HW01 V0**

Product Specification

◆ **Power Sequence of Inverter**

Parameter	Values			Unit
	Min.	Typ.	Max.	
T1	20	-	-	ms
T2	0	-	-	ms
T3	500	-	-	ms
T4	0	-	-	ms
T5	1	-	-	ms
T6	-	-	10	ms

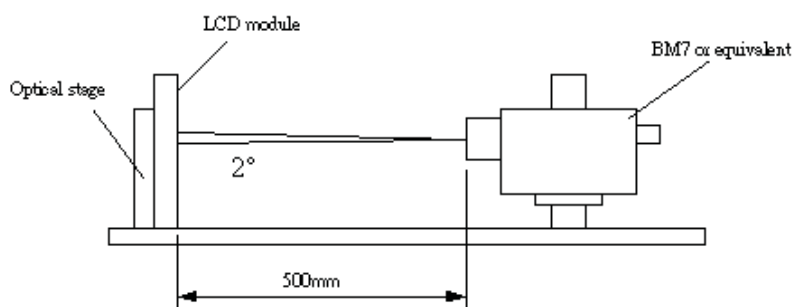
Model Name: **P520HW01 V0**

Product Specification

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of ϕ and θ equal to 0°.

Test condition:



(Ta=25±5°C, Turn-on after 60mins)

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max		
Contrast Ratio	CR	3000	4000	--		1
Surface Luminance (White)	L _{WH}	550	700	--	cd/m ²	2
Luminance Variation	δ _{WHITE(9P)}	--	--	1.3		3
Response Time (Average)	T _R	--	8	--	ms	5 (Gray to Gray)
Rising Time	T _r		15	25	ms	4
Falling Time	T _f		8	10	ms	4
Color Coordinates						
Red	R _x	Typ.-0.03	0.64	Typ.+0.03		
	R _y		0.33			
Green	G _x		0.29			
	G _y		0.6			
Blue	B _x		0.15			
	B _y		0.06			
White	W _x		0.28			
	W _y		0.29			
Viewing Angle						(Contrast Ratio>10)
x axis, right(φ=0°)	θ _r	--	89	--	degree	6
x axis, left(φ=180°)	θ _l	--	89	--	degree	6
y axis, up(φ=90°)	θ _u	--	89	--	degree	6
y axis, down (φ=270°)	θ _d	--	89	--	degree	6

Model Name: **P520HW01 V0**

Product Specification

Note:

1. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio(CR)} = \frac{\text{Surface Luminance with all "white" pixels}}{\text{Surface Luminance with all "black" pixels}}$$

2. Surface luminance is luminance value at point 1 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see Fig. 4-2. When $V_{DDB} = 24V$, $I_{DDB} = 12.5 A$. $L_{WH} = L_{on1}$, Where L_{on1} is the luminance with all pixels displaying white at center 1 location.

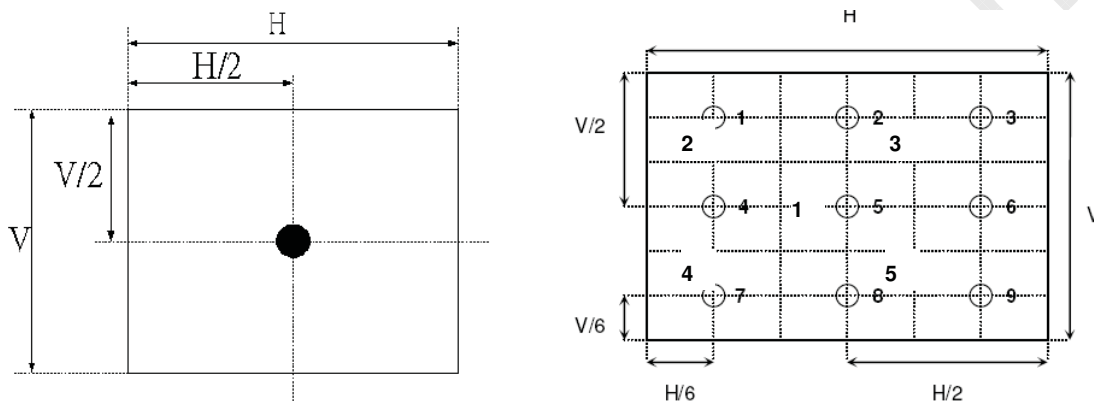


Fig.4-2 Optical measurement point

3. The variation in surface luminance, δ_{WHITE} is defined under 100% brightness as:

$$\delta_{WHITE(5P)} = \text{Maximum}(L_{on1}, L_{on2}, \dots, L_{on5}) / \text{Minimum}(L_{on1}, L_{on2}, \dots, L_{on5})$$

4. Response time is the time required for the display to transition from white(L255) to black(L0) (Decay Time, $Tr_D = T_f$) and from black(L0) to white(L255) (Rise Time, $Tr_R = T_r$). For additional information see Fig. 4-3.

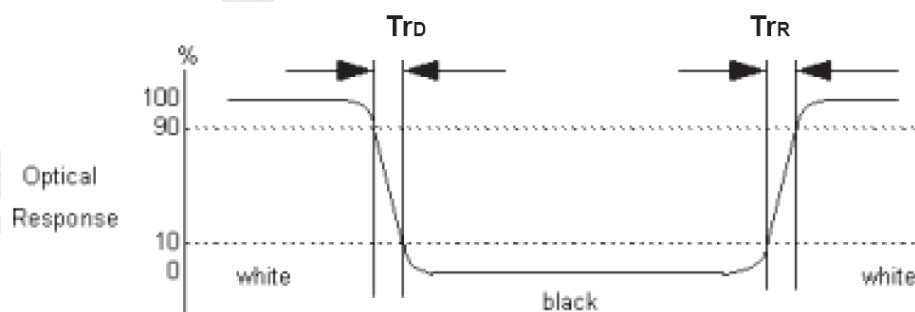


Fig.4-3 Response time

5. The response time is defined as the following figure and shall be measured by switching the input signal among 0%, 25%, 50%, 75%, 100% luminance. For additional information see Fig. 4-4.

	0%	25%	50%	75%	100%
0%		t: 0%-25%	t: 0%-50%	t: 0%-75%	t: 0%-100%
25%	t: 25%-0%		t: 25%-50%	t: 25%-75%	t: 25%-100%
50%	t: 50%-0%	t: 50%-25%		t: 50%-75%	t: 50%-100%
75%	t: 75%-0%	t: 75%-25%	t: 75%-50%		t: 75%-100%
100%	t: 100%-0%	t: 100%-25%	t: 100%-50%	t: 100%-75%	

Fig.4-4 Response time

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see Fig. 4-5. (Optical measurement by SR3)

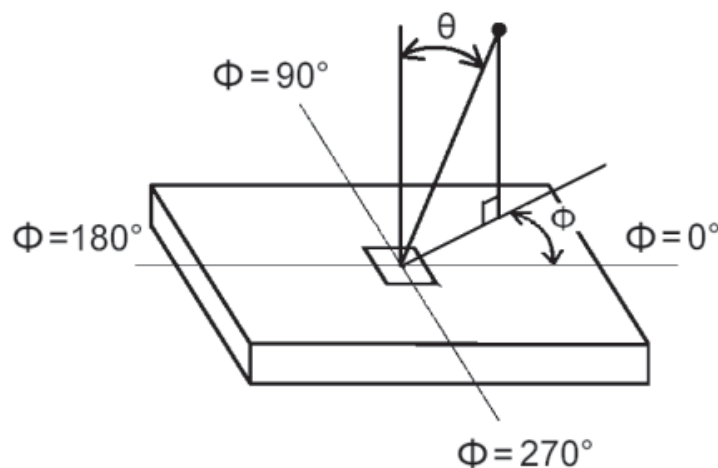


Fig.4-5 Viewing Angle Definition

Model Name: **P520HW01 V0**

Product Specification

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model P520HW01 V0. Detailed mechanical drawings are shown in the following pages.

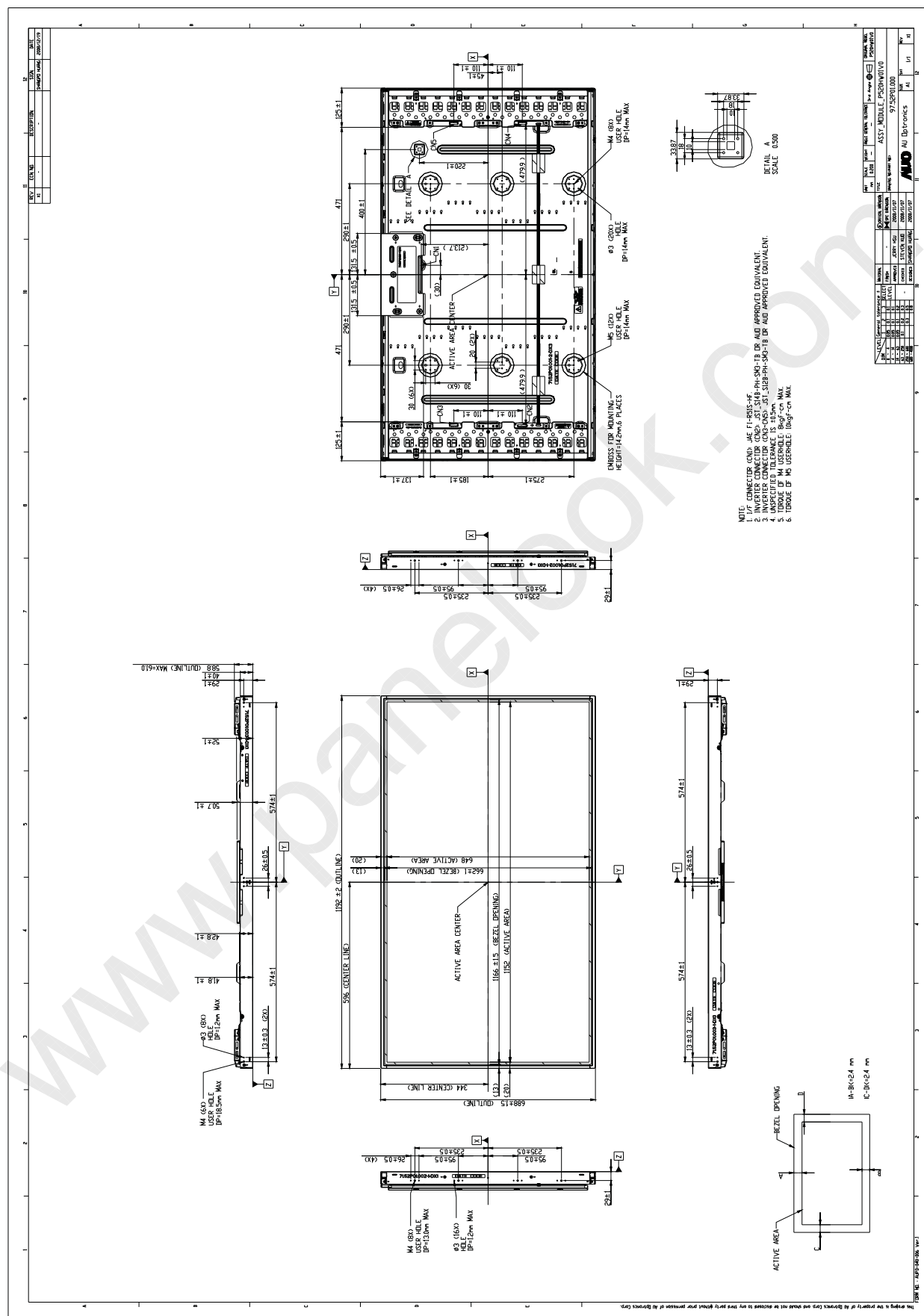
Outline Dimension	Horizontal (typ.)	1192 mm
	Vertical (typ.)	688 mm
	Depth (typ.)	61 mm (with inverter)
Bezel Opening Area	Horizontal (typ.)	1166 mm
	Vertical (typ.)	662 mm
Active Display Area	Horizontal	1152 mm
	Vertical	648 mm
Weight	20 KG (Max)	



Model Name: **P520HW01 V0**

Product Specification

2D Drawing (Front)



Model Name: **P520HW01 V0**

Product Specification

Packing

6. Reliability Test

No	Test Item	Condition
1	High temperature storage test	Ta=60℃ , 300hr judge
2	Low temperature storage test	Ta=-20℃ , 300hr judge
3	High temperature/High humidity operation test	Ta=50℃ , 80%RH, 300hr judge
4	High temperature operation test	Ta=50℃ , 300hr judge
5	Low temperature operation test	Ta=-5℃ , 300hr judge
6	Thermal shock	-20℃/0.5hr ~ 60℃/0.5hr, 100cycle
7	Vibration test (non-operating)	Wave form: Random Vibration level: 1.5G RMS, Bandwidth: 10-500Hz Duration: X, Y, Z (30min one time each direction)
8	Shock test (non-operating)	Shock level: 30G Waveform: half sine wave, 11ms Direction: ±X, ±Y, ±Z (One time each direction)
9	Vibration test (with carton)	Wave form: Random Vibration level: 1.5G RMS, Bandwidth: 10~200Hz Duration: X, Y, Z (30min each direction)
10	Drop test (with carton)	Height: 25.4cm 6 surfaces (ASTMD4169-I)

Model Name: **P520HW01 V0**

Product Specification

7. International Standard

7.1. Safety

- (1) UL60065,2003, Underwriters Laboratories, Inc. (AUO file number : E204356)
Audio, video and similar electronic apparatus, safety requirement
- (2) UL60950-1,2003, Underwriters Laboratories, (AUO file number : E204356)
Standard for safety of information technology equipment including electrical business equipment
- (3) EN60065
- (4) EN60950
- (5) IEC 60065, European Committee for Electro technical Standardization (CENELEC)
Audio, video and similar electronic apparatus, safety requirement
- (6) IEC 60950-1:
European Committee for Electrotechnical Standardization (CENELEC)
European Standard for safety of information technology equipment including electrical business equipment

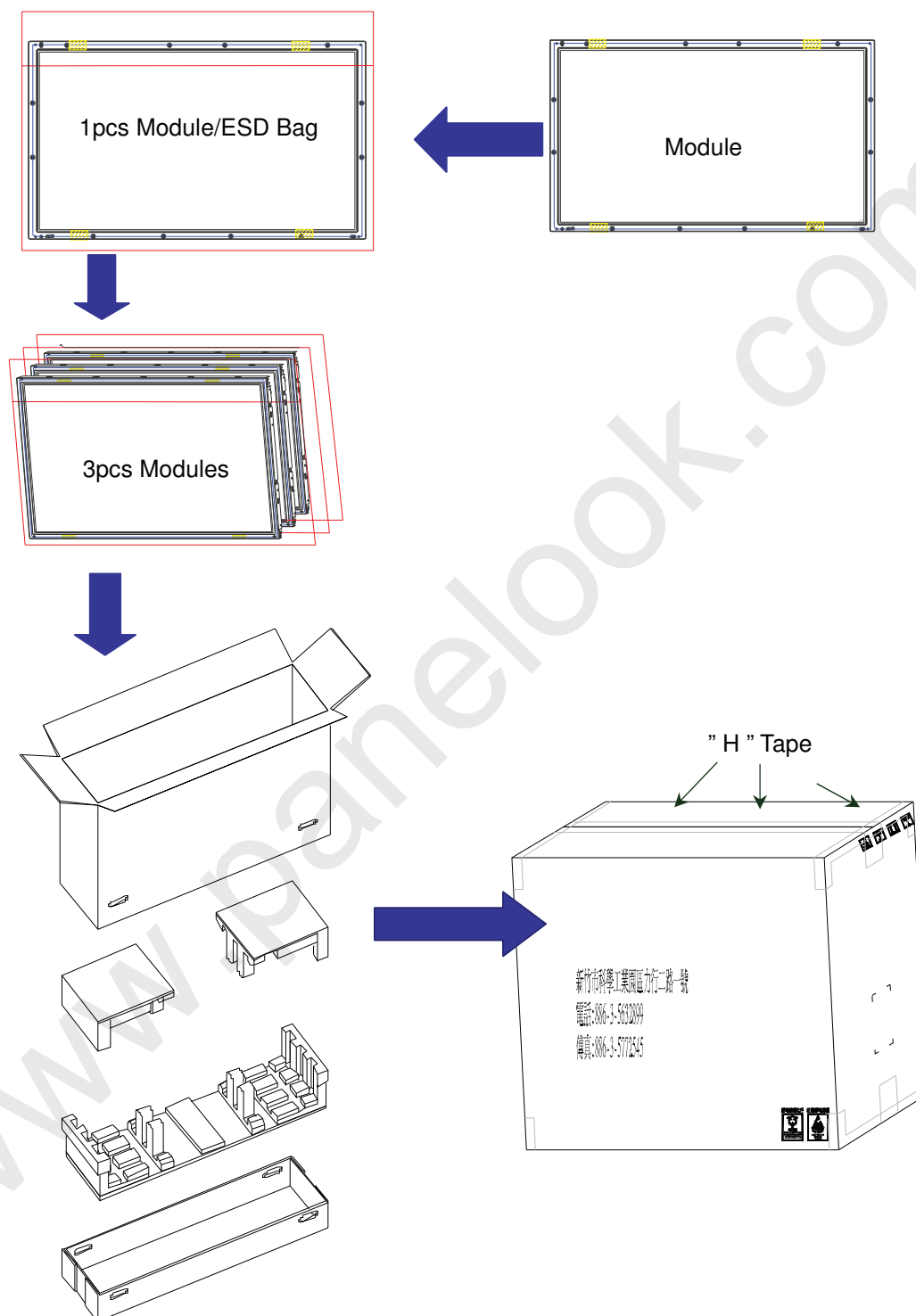
7.2. EMC

- (1) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992
- (2) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (3) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

Model Name: **P520HW01 V0**

Product Specification

8. Packing



Package Information:

Model Name: **P520HW01 V0**

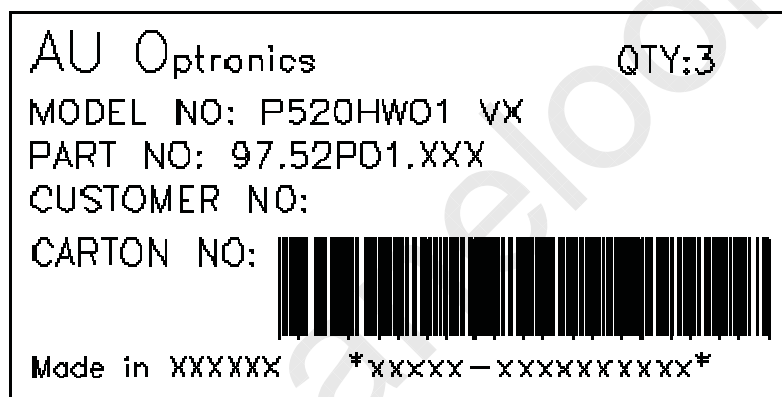
Product Specification

Carton outside dimension: 1270(L)mm× 370(W)mm× 820(H)mm

Carton/Package weight:3.7 kg

EPE Cushion : 4.4 Kg

Gross weight (per Box): 65 kg

Shipping Label (on the rear side of TFT-LCD display)**Green Mark Description:**For Pb Free products, AUO will add  for identification.For RoHS compatible products, AUO will add  for identification.**Note:** The Green Mark will be present only when the green documents have been ready by AUO Internal Green Team. (The definition of green design follows the AUO green design checklist.)**Carton label****Pallet Information**

By air cargo : (3x1) x1 layers, one pallet put 3 boxes, total 9 pcs module.

By sea: (3x1) x2 layers, one pallet put 6 boxes, total 18 pcs module.

Pallet dimension : 114 m m× 1320 m m *138 m m

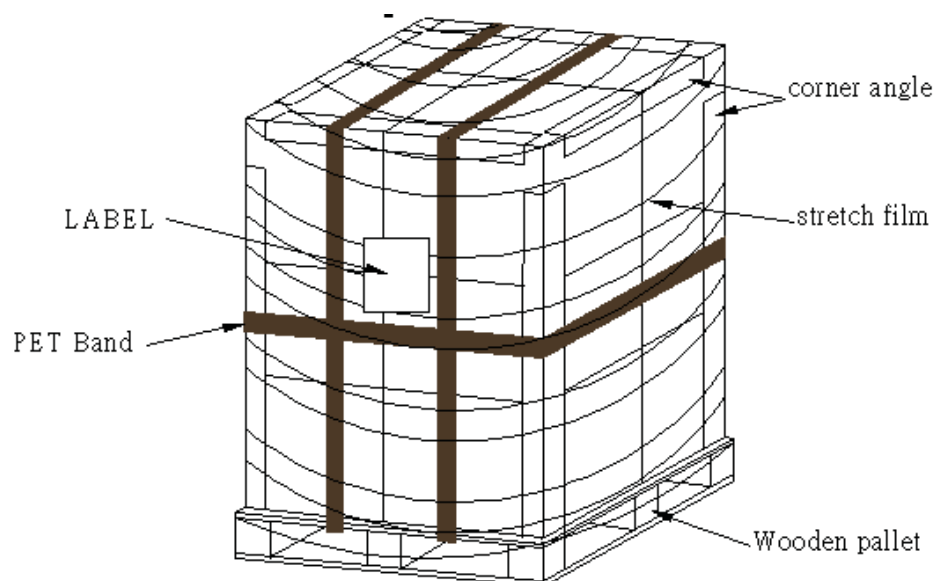
Pallet weight: 15.5kg

By air total weight: 65 kg/box X 3 boxes=195 kg (with pallet weight 210.5 kg)

By sea total weight: 65 kg/box X 6 boxes=390 kg (with pallet weight 421 kg)

Model Name: **P520HW01 V0**

Product Specification



9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9.1. MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged on back or edge side of panel.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

Model Name: **P520HW01 V0**Product Specification

9.2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:
 $V=\pm 200\text{mV}$ (over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness of CCFL depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

Model Name: **P520HW01 V0**

Product Specification

9.3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9.4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9.5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

9.6. HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the Bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the Bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

9.7. Operating Condition in PID Application

- (1) If the continuous static display is required, periodically inserting a motion picture is strongly recommended.
- (2) Recommend to periodically change the background color and background image.
- (3) Recommend not to continuously operate over 18 hours a day.
- (4) Recommend to adopt one of the following actions after long time display.
 - I. Running the screen saver (motion picture or black pattern)
 - II. Power off the system for a while
- (5) Try not to run the LCD in a closed environment. Suitable venting on the system cover would be helpful for cooling.
- (6) It is better to adapt active cooling with fans for long time displaying, especially for high luminance LCD model.